



UNIVERSITI PUTRA MALAYSIA

**WATER RESOURCE MANAGEMENT OPTIONS
IN THE SEAWATER IRRIGATION PROJECT
IN KUNG KRABAE, THAILAND**

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FSAS 1999 41

**WATER RESOURCE MANAGEMENT OPTIONS
IN THE SEAWATER IRRIGATION PROJECT
IN KUNG KRABAEN, THAILAND**

By

SOMSAK TANTISAOWAPHAP

**Dissertation Submitted in Fulfilment of the Requirements for
the Degree of Doctor of Philosophy in the Faculty of
Science and Environmental Studies,
Universiti Putra Malaysia**

May 1999



ACKNOWLEDGEMENTS

First of all, I wish to seek forgiveness from my father who has fallen sick and I could not take care of him during my period of study abroad. I am also greatly indebted to my mother who taught me to overcome obstacles in life.

I am immensely grateful to Assoc. Prof. Dr. Mohammad Ismail Bin Yaziz, Chairman of the Supervisory Committee, Prof. Dr. Mohd. Ibrahim Hj. Mohamed, and Dr. Azizi Bin Muda, members of my Supervisory Committee for their guidance, invaluable comments and suggestions in the execution of the research work and preparation of this thesis.

I wish to thank the Department of Fisheries, Thailand for granting me study leave, the Southeast Asian Regional Centre for Graduate Study and Research in Agriculture (SEARCA) for their financial support, the Kung Krabaen Bay Royal Development Study Centre and all staffs for providing the facilities for my study, and not to forget, all the shrimp farmers in Kung Krabaen Bay area who helped me in collecting data and making this research viable.

Appreciation is extended to my best friend, Mr. Nayandeep Singh for his assistance in correcting this manuscript and my Malaysian friends in 9th college for their friendship.

I am grateful to my sisters and brother who have given me morale support and encouragement throughout my study in Malaysia.

Last but not the least, I would like to extend my sincere appreciation to my beloved wife Waree, and son Patameen, for their patience during my absence from home.

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Abstract of the dissertation submitted to the Senate of Universiti Putra Malaysia
in fulfilment of the requirements for the degree of Doctor of Philosophy

**WATER RESOURCE MANAGEMENT OPTIONS
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By

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May 1998

Chairman : Associate Professor Mohammad Ismail Bin Yaziz, Ph.D.

Faculty : Science and Environmental Studies

The purpose of this study was fourfold as follows: Firstly, to elucidate problems related to shrimp culture in Kung Krabaen Bay. Secondly, to study trends in water quality in the Kung Krabaen Bay. Thirdly, to determine the perception of the shrimp farmers on a number of matters about the Seawater Irrigation Project, and finally to determine the most appropriate methods for managing the new water resource associated with the Seawater Irrigation Project.

The methodology for the study consisted of field observations, questionnaire surveys, sampling and analysis of water and wastewater, and discussions with some relevant authorities and NGOs connected with the study. The field work was

carried out from September 1996 to September 1997 in Kung Krabaen Bay. Sampling of water in the shrimp ponds was carried out over two cropping seasons with each crop consisting of ten ponds. Each water sample was analysed for Dissolved Oxygen, Biochemical Oxygen Demand, Nitrite, Nitrate, Ammonia, pH, Salinity, Water Temperature and Suspended Solids. The interview form was pre-tested in October 1996, improved, and real data was gathered beginning February 1997. A total of 88 respondents were used in the social survey. All data were then analysed for frequencies, means, standard deviation, and percentage. In addition, the t-test and one-way ANOVA were employed to compare water quality values.

The following conclusions are based on the findings of the study:

1. The main causes of failure in the shrimp farms in Kung Krabaen Bay was due to poor environmental conditions and weaknesses in the farm management system that allowed for infection of the shrimps by yellow head bacuvirus.
2. The major problem of water quality deterioration in Kung Krabaen Bay occur mainly in the canals and in the inner coast region. The lack of separate fresh seawater resource and wastewater discharge canals exacerbated the problems of obtaining good quality water for efficient shrimp farming.
3. The trend in water quality variations indicated improvements from 1995 to 1997 and this may be attributed to the change in the shrimp farming system from

an intensive system to a closed system. Nonetheless, this improvement is still not adequate to provide a suitable water resource for shrimp farming in the future. A new fresh seawater resource will be required to rejuvenate the shrimp industry in Kung Krabaen.

4. The Seawater Irrigation Project being developed by the KKBC promises a suitable new water resource for shrimp farming. However, local participation in the project planning and development is poor and appropriate management systems for the new water resource needs to be identified.

5. The water resource management system proposed by the project proponent has some inherent weaknesses especially with respect to the rate of water supply and the duration of supply. Depending on the type of shrimp farming system being practiced, the water demand may exceed the supply capacity. In addition, the schedule for pumping seawater would cause a lot of inconvenience to the farmers.

6. The “Arrange Supply” system is a suitable system for managing the new seawater resource in the short-term because this system is based on the expected water needs of the crop and is technically simple to operate. However, it places some constraints on the farmer in terms of the type of shrimp farming system that may be practiced and the scheduling of shrimp farming activities. The system which is suitable for operating the seawater resource in the long-term is the “Semi-

Demand Supply” system which is more flexible but still environmentally friendly.

However, it requires more careful planning and operational expertise.

7. The important criteria for the success of the Seawater Irrigation Project are (a) the mode of shrimp culture being practiced, (b) the water resource management system, (c) preservation of the water quality in the Gulf of Thailand, and (d) research and extension activities of the KKBC. Some recommendations are presented for each of these criteria aimed at augmenting and supporting the success of the new water resource management system to ensure successful shrimp farming operations in the future.

Abstrak disertasi yang di kemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi syarat untuk ijazah Doktor Falsafah

**OPSYEN PENGURUSAN SUMBER AIR DALAM
PROJEK PENGALIRAN AIR LAUT DI
KUNG KRABAE, THAILAND**

Oleh

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Mei 1998

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Objektif kajian mempunyai empat perkara seperti berikut: Pertama, menentukan masalah berkaitan dengan pengkulturan udang di Teluk Kung Krabaen. Kedua, mengkaji tren perubahan kualiti air di Teluk Kung Krabaen. Ketiga, menentukan tanggapan para-penternak udang terhadap beberapa perkara berkaitan dengan projek pengaliran air laut, dan akhirnya untuk menentukan kaedah-kaedah yang paling sesuai bagi menguruskan sumber air baru berkaitan dengan Projek Pengaliran Air Laut ini.

Kaedah yang digunakan dalam kajian ini meliputi pemerhatian lapangan, tinjauan soal-selidik, mengambil dan menganalisis sampel air dan air sisa, dan

perbincangan dengan beberapa pihak berkuasa dan NGO (Pertubuhan Bukan Kerajaan) yang mempunyai kaitan dengan kajian ini. Kerja lapangan dimulakan dari September 1996 sehingga September 1997 di Teluk Kung Krabaen. Penyampelan air daripada kolam udang telah dilakukan dalam dua musim penternakan dan setiap musim melibatkan penyampelan daripada sepuluh buah kolam. Setiap sampel air dianalisis untuk Oksigen Terlarut, Permintaan Oksigen Biokimia, Nitrit, Nitrat, Amonia, pH, Kemasinan, Suhu Air dan Pepejal Terampai. Ujian awal borang soal-selidik telah dilakukan pada bulan Oktober 1996, diperkemas, dan data lapangan mula dikumpulkan pada bulan Februari 1997. Saiz sampel dalam kajian sosial terdiri daripada 88 responden. Semua data kemudiannya dianalisis untuk frekuensi, min, sisihan piawai dan peratusan. Ujian T-test dan ANOVA turut digunakan untuk perbandingan nilai kualiti air.

Berikut adalah kesimpulan yang didapati daripada kajian ini:

1. Faktor-faktor utama yang menyumbang kepada kegagalan pengkulturan udang di Teluk Kung Krabaen ialah keadaan alam sekitar yang kurang baik dan kelemahan pada sistem pengurusan ladang ternakan yang menggalakan penyakit yellow head pada udang yg ditenak.

2. Masalah terbesar kemerosotan kualiti air di Teluk Kung Krabaen terdapat di bahagian terusan dan bahagian pendalaman kawasan pantai. Ketidakhadiran pemisahan diantara bekalan air laut bersih dengan air sisa terusan telah

memudaratkan masalah untuk mendapatkan kualiti air yang baik untuk pengkulturan udang secara cekap.

3. Tren perubahan kualiti air menunjukkan peningkatan pada beberapa parameter kualiti air dari 1995 sehingga 1997. Peningkatan ini adalah akibat perubahan pada sistem pengkulturan udang dari pada sistem intensif kepada sistem tertutup. Walau bagaimanapun, peningkatan kualiti air ini masih tidak cukup untuk menyediakan sumber air yang sesuai untuk pengkulturan udang pada masa hadapan. Sumber air laut segar yang baru diperlukan untuk merangsang industri pengkulturan udang di Teluk Kung Krabaen.

4. Projek Pegaliran Air Laut yang sedang diusahakan oleh KKBC boleh menjamin bekalan sumber air yang baru untuk pengkulturan udang. Walau bagaimanapun, penglibatan penternak serta orang ramai dalam perancangan dan pembangunan projek ini adalah rendah dan suatu sistem pengurusan yang bersesuaian untuk sumber air yang baru ini perlu dikenalpasti.

5. Cadangan sistem pengurusan sumber air yang baru ini oleh penggerak projek mengandungi beberapa kelemahan, terutamanya pada kadar pengaliran bekatan air dan tempoh masa bekalan. Bergantung kepada sistem pengkulturan udang yang diamalkan, permintaan air mungkin melebihi keupayaan bekalan. Tambahan pula, jadual pembekalan air mungkin menyebabkan pelbagai masalah kepada penternak udang.

6. Sistem “Arrange Supply” merupakan sistem yang sesuai untuk mengurus sumber air laut yang baru ini dalam jangkamasa pendek kerana ianya berdasarkan permintaan air se-musim dan secara teknikal mudah untuk dikelolakan. Walau bagaimanapun, sistem ini menimbulkan sedikit desakkan kepada penternak dari aspek sistem pengkulturan udang yang boleh diamalkan dan jadual aktiviti pengkulturan. Sistem “Semi-Demand Supply” adalah lebih sesuai untuk mengurus sumber air laut ini dalam jangkamasa panjang kerana ianya lebih lentur dan mesra alam. Akan tetapi, sistem ini memerlukan perancangan yang rapi dan kepakaran untuk operasi.

7. Kriteria penting untuk menjayakan Projek Pengaliran Air Laut ini meliputi (a) mod kultur udang yang diamalkan, (b) sistem pengurusan sumber air, (c) pemeliharaan kualiti air di Gulf of Thailand, dan (d) aktiviti penyelidikan dan pemanjangan di KKBC. Beberapa saranan dimajukan untuk setiap kriteria ini bertujuan untuk menambah serta menyokong kemajuan sistem pengurusan sumber air bagi memastikan kejayaan aktiviti pengkulturan udang di masa hadapan.

CHAPTER I

INTRODUCTION

Fishery activities in Thailand have undergone rapid development in the 1990's. Thailand was the first country in the world to export commercial dish fishery products (Department of fisheries, 1994a). The industry earned 86 billion Baht (US\$ 3.44 billion) in with more than 40 percent of it coming from giant tiger prawn (*Penaeus monodon*) culture. The prawn industry alone has generated about 40 billion Baht (US\$ 1.6 billion) in export earnings for Thailand annually (Department of fisheries, 1994a). Consequently there is continuing expansion of giant tiger prawn farming activities in Thailand. Currently, the most important areas for giant tiger prawn farming are the coastal areas in the Gulf of Thailand and the Andaman Sea.

Chanthaburi Province which is on the eastern coast of the Gulf of Thailand is a major giant tiger prawn farming area. In 1991, the total area under shrimp farming in Chanthaburi Province was about 50,958 ha comprising private individual and commercial enterprise farms (Kung Krabaen Bay Royal Development Study Centre, 1994). The size of the farms vary between 0.16 ha to 16 ha with stocking rates of about 580,000 shrimp/ha. Ponds are harvested twice a year with yields varying from 0.9 to 13.3 tonnes/ha. However, while some shrimp

farmers had succeeded in producing high harvests, others had experienced low yields. Preliminary observations have indicated that in many cases, the low yields had stemmed primarily from problems of water quality in the shrimp ponds. The major causes for the water quality problems include the lack of appropriate wastewater treatment systems and inappropriate control over the use of water and its discharge.

The Kung Krabaen Bay Royal Development Study Centre (KKBC) in Chanthaburi Province was set up under the auspices of His Majesty the King of Thailand to study and develop coastal areas where shrimp farming is abundant. The KKBC project area consists of a mangrove forest area of 358.4 ha, of which about 144 ha is to be conserved, 48 ha for reforestation of mangrove and 166.4 ha for giant tiger prawn farming (Figure 1). The latter area has been divided into 104 plots allocated for shrimp farming. Each plot consists of three shrimp ponds. Each pond was planned to take up about 0.32 ha (Department of Fisheries, 1994b).

Shrimp culture practices in the KKBC has developed following a closed system whereby there is a low rate of water exchange during crop production. However, the water supply for shrimp culture in the farms comes from canals which are connected to Kung Krabaen Bay. Wastewater from the ponds are also discharged into the same canal which then flows back into the Bay. Although some farmers have ponds to contain sludge from the shrimp ponds, the raw

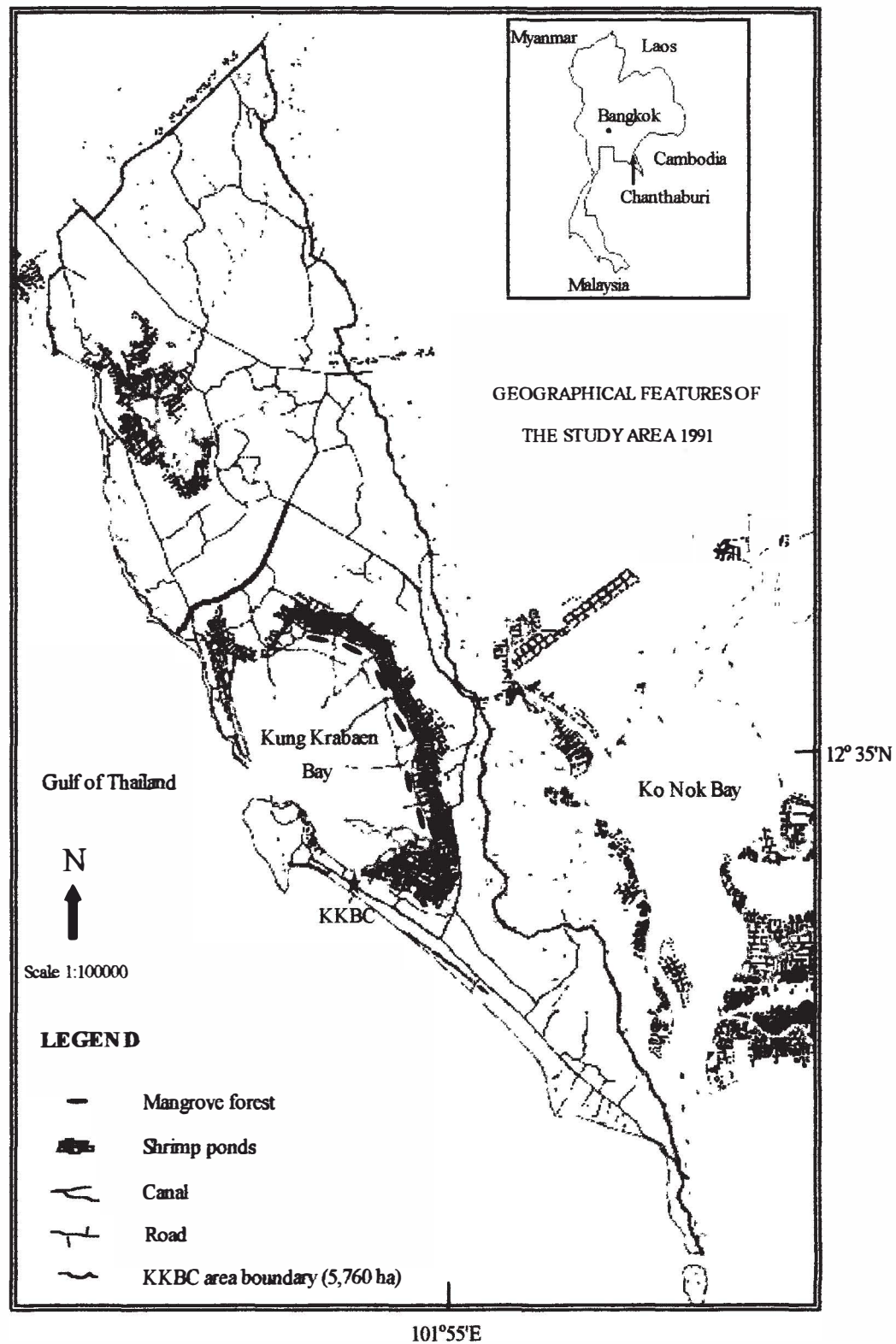


Figure 1: Map of the General Land Use Around the Kung Krabaen Bay Royal Development Study Centre. (Source: KKBC, 1994)